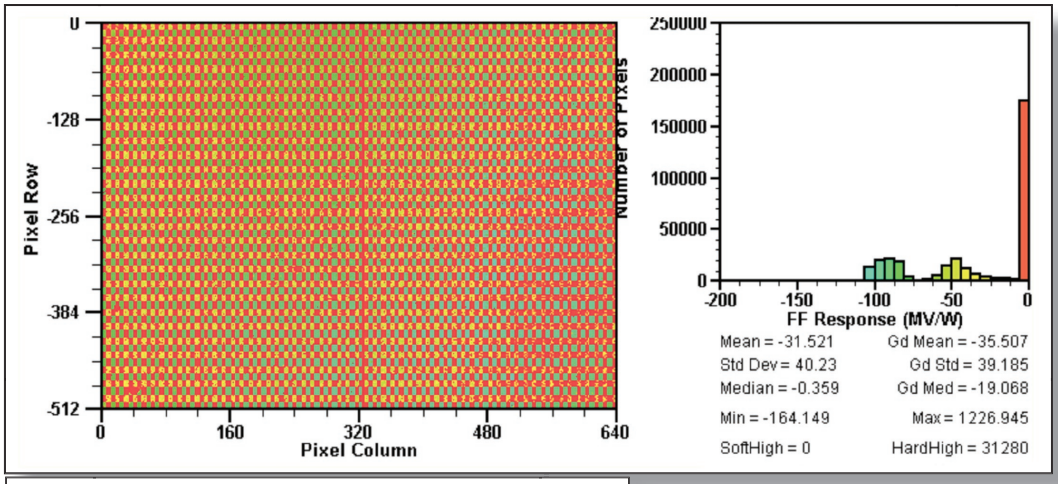
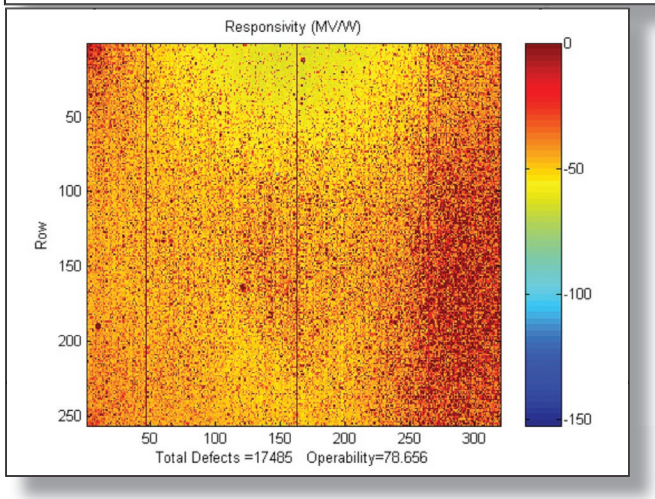
Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

320 X 256 PIXEL, DUAL-LWIR WAVEBAND FPA DEVELOPMENT





Dual-band focal plane arrays (FPAs) allow for systems applications with savings in volume, mass, and cryogenic cooling, relative to the more traditional approaches involving two single waveband FPAs and beam-splitting optics.

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Accomplishment

The Space Vehicles Directorate evaluated dual-band FPAs developed recently as part of Lot 4 for the Missile Defense Agency Advanced Sensors (MDA/AS) Technology program that show the better FPAs achieve good imagery in both wavebands, with values of pixel response operability in the 90% regime. The shorter waveband (with cut-off wavelength near 8 microns at the 60 Kelvin operational temperature) also exhibits similarly high values in sensitivity operability.

Sensitivity operability is indicative of both pixel response (and noise) uniformity with respect to the FPA mean and becomes increasingly challenging for the longer wavebands of the dual-band technologies. A derivative of the technology forms the basis of risk reduction for the Navy Standard Missile 3, Sea-based Midcourse Seeker.

Background

MDA/AS provided funding for the directorate's Improved Multi-waveband IR Array (IMIRA) program to develop high-sensitivity, dual-band FPAs. The directorate awarded the IMIRA program to DRS Infrared Technologies of Dallas, Texas, as a vehicle for executing research initiative efforts for dual-band and longer long wavelength infrared cut-off wavelengths.

Directorate researchers evaluated the FPAs delivered by DRS Infrared Technologies under the IMIRA program in the directorate's characterization facility, largely verifying the performance claims of the manufacturer. DRS Infrared Technologies developed the high-density, vertically interconnected photodiode (HDVIP) process for single waveband FPAs in response to the Defense Advanced Research Projects Agency's Infrared FPA's Flexible Manufacturing program.

The processing begins with tellurium-rich, liquid phase epitaxial growth of p-type detector material diced and epoxied onto cryogenic multiplexers. DRS Infrared Technologies makes interconnects to the multiplexer pads with the etching of vias, followed by their metallization (with this step representing a substantial deviation from the indium bump interconnection used by most other infrared FPA manufacturers). At the time of the via etching process, DRS Infrared Technologies converts the axial region surrounding the via from p- to n-type, thereby forming the photodiode.

The advantages of the HDVIP process for dual-band applications include high values of optically active area for all wavebands and exact collocation of pixels for each band, high cryogenic reliability, and reduced probability of a pixel outage in one band affecting its spatial counterpart.

Space Vehicles
Emerging Technologies

Additional information

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